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ABSTRACT

The primary purpose of the present study was to examine how prevalent were concerns about restarting Three Mile Island nuclear reactor Unit I among people within a five-mile radius of the plant four years after the accident involving reactor Unit II. Also explored were concerns related to expectations about the restart of Unit I, perception of control, and selected demographic variables. A stratified random sample of residents of 221 households was interviewed. These were chosen from over 4,000 households in Middletown, Pennsylvania. Recent arrivals in Middletown served as a control group. Of the residents surveyed, 60 percent or more expressed some concern about each of the questions and long-time residents were more concerned than those who moved in since the accident. Concern about radioactive emissions is greater now than before the accident and focuses on the possibility of future accidents, radiation exposure during the cleanup, and developing cancer or radiation disease. Those who were residents of Middletown at the time of the accident reflect less sense of personal control over important life events and more loss of faith in experts than do recent arrivals, suggesting the impact of the accident on the sense of personal control. People's position on whether or not to restart Unit I focused more on health hazards than on political ideology about nuclear power. Slightly over half felt that it should not be restarted, a drop from two-thirds reported in 1982. (IS)

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Understanding Victims of Technological Disaster: Beliefs and Worries of Three Mile Island

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Three Mile Island Accident: Brief History and Update

INTRODUCTION

On March 28, 1979, the community located near the Three Mile Island Nuclear Generating Facility experienced what has been described as the worst recorded Nuclear Accident. At that time, the experience presented residents of Middletown, the town adjacent to the Nuclear facility, the threat of immediate damage for themselves and their loved ones due to possible meltdown in the core of Unit II, and exposure to undetermined levels of radioactive gases, the results of which would not be immediately apparent.

During the days of the accident, area residents experienced confusing sometimes contradictory information from experts and officials (Houts, Miller, Tokuhata and Ham, 1980). Some residents report having heard more about the reality of their situation from national news than from local reports (Houts et al, 1980). On March 30th "Black Friday", when most in the community was apprised of the actual seriousness of the situation, as many as 150,000 area residents evacuated the area (Flynn, 1981), many considering the possibility that they might never again return to their homes because of radiation contamination.

Since that time, although, the initial crisis has past, many area residents report that stressors associated with the event remain (Vyner, 1984; Baum et al., 1983, Walsh, 1981). These stressors may be categorized as 1) Difficulties associated with clean-up operations of Unit II, the damaged reactor; 2) Differences in opinion on the safety of re-starting Unit I; 3) Unanswered questions regarding health effects of the TMI accident on area residents.

Clean-up

Since the accident, contaminated water has remained in Unit II, the damaged reactor, resulting in a buildup of radioactive gases that are vented daily (Patriot News, Harrisburg, daily report). As of Fall 1983, clean-up operations had been delayed by uncertainty about how it should precede, and questions about who should pay. More than four years since the

accident, attempts at clean-up have been plagued with mishaps including a faulty crane and most recently mild skin contamination for at least six of the workers envolved in clean-up (Patriot News, March 1984).

Restart

In addition to concerns about clean-up of Unit II, the community faces the question of whether Unit I, not involved in the near melt-down, should be restarted. Some area residents and the Union of Concerned Scientists have opposed the granting of permission to restart Unit I based on questions of "hardware safety" and "management integrity." Questions of safety have focused on the existence of faulty steam tube generators in Unit I which the Union of Concerned Scientists suggest may allow additional releases of radioactive gases into the atmosphere.

Regarding "management integrity," reports by ex-employees of GPU, "whistle blowers," have brought to light falsification of radioactive water leak rates that occurred at TMI prior to the accident. Additionally, nuclear operators at the plant have been found guilty of cheating on qualifying exams. The company has been indicted on counts of criminal misconduct regarding illegal discharge of radioactive water and falsification of monitoring records. At trial, the corporation pleaded guilty to one charge and nolo contendere to seven others.

As of July 27, 1984 the Nuclear Regulatory Commission staff recommended approval of restart of Unit I at 25% operating rate with the assumption that this would not present undue risk to the public health and safety (Patriot, 1984). (As of May 29, 1985 the NRC granted full permission for restart of Unit I).

Health Issues

Since the accident in 1979, many unanswered questions remain regarding possible health effects in the community. Uncertainty remains about the actual amount of radiation

released at the time of the accident, as the dosimeters at the plant were inoperable at the time of the accident. Considerable controversy remains among professional and between professionals and community members about the actual amount released. Many community members report having experienced metalic tastes, and unusual odors at the time of the accident which would suggest higher releases than cited by official estimates. These reports have been publicly dismissed by several experts as stress related. The question of dose assessment is further complicated in the opinion of some experts by the fact that wind currents at the time of the accident would have distributed radioactive releases or plumes unevenly depending on geographic location and elevation, exposing some individuals to higher doses of radiation.

Assessment of possible health effects are complicated by the fact that effects of low radiation take considerable time to manifest themselves and are subject to much individual variation. Early attempts to assess health effects by the PA State Health Department concluded that there were no adverse health effects. This conclusion was met with considerable criticism by community members. Criticism focused on the methodology of these studies which averaged symptom appearance over a five mile radius, with no attention to possible areas of high symptom concentration. Criticism also focused on an earlier error in calculations in which 88 infant mortalities were not included in the analysis. At the time of our survey, there was no ongoing systematic assessment of health effects in the community and funds for a follow-up study by the PA Health Department had not been approved.

Community Response

Assessment of TMI area responses to the accident have focused on three themes: restart position (Walsh, 1983, 1982, 1981), stress (Baum et al., 1983, 1982, 1981) and altered perception of control (Titchener, 1981; Houts, 1980; Vyner, 1982).

Restart and Politicization

Much of the previous research on restart position has looked at restart position as reflective of politicization (Houts, Walsh, 1983, 1982, 1981; Rooney and Prince-Embury, 1984). Houts (1980) found that 15% of those polled in the community had been active or at least attended a meeting to influence what happened at TMI Unit I. Houts concluded that this percentage was high when compared with a National Opinion Poll in 1973 which showed a comparable activism percentage of 5%. Walsh (1983, 1982, 1981) has explained political mobilization of middle class citizens in the TMI area as response to specific grievances rather than political ideology. Rooney and Prince-Embury (1984) found restart position related to concern about atomic energy but not related to any particular political ideology or special concern about pollution or war.

Stress

Research on stress in the TMI community consists of self-reported symptoms experienced shortly after the accident (Houts et al., 1981, 1980; Bromet, 1980; Flynn, 1979); physiological, behavioral and self-report indicators up to two years following the accident (Baum et al., 1981, 1982, 1983); and verbal statement of TMI specific worries (Vyner, 1982; Houts, 1980; Opinion Research Corp., 1980, 1981).

Houts et al. (1981) found that between 10% and 20% of the population living within 15 miles of TMI had heightened levels of distress symptoms up to at least nine months after the initial crisis. Bromet (1980) found that the rate of clinical episodes of depression and/or anxiety following the TMI accident was more than would be anticipated.

Continuing effects were found in area residents in greater symptom reporting, greater risk for psychiatric problems; poorer task performance, higher urinary catecholamine levels than manifested by comparable control populations as long as two years after the accident (Baum et al., 1983, 1981; Bromet and Dunn, 1981; Houts and Goldhaber, 1981; Flynn and Chambers, 1980).

Specific Health Related Fears

Public opinion polls commissioned by GPU in 1980-81 found that 14% of those surveyed within a 5 mile radius believed that they had received a dangerous dose of radiation during the Three Mile Island Accident; 25% were unsure. Forty-nine percent of those polled believed they stood a good chance of getting a dangerous dose of radiation sometime in the future; 19% were unsure. Houts et al. (1980) found that 54% of those living within 5 miles of TMI agreed that cancer rates would increase in the area because of TMI.

In a more recent survey, Vyner (1982) found 42.6% of those interviewed agreed that "it is a matter of time until I or someone I know develops a cancer caused by radiation released from TMI"; of those 23.9% strongly agreed.

Altered Perception of Control

Previous studies of disaster victims have identified a shattering of basic assumptions of invulnerability, a sense of helplessness against overpowering forces and preoccupation that the disastrous event may reoccur (Lifton and Olson, 1976; Perloff, 1983; Titchener, Kapp and Winget, 1976; Wolfenstein, 1957; Grinker and Spiegal, 1945; Janis, 1974; Weisman, 1979). Davidson, Baum and Collins (1982) found that TMI area residents reported greater feelings of helplessness and less perceived control over their environment than did control subjects. Baum et al (1983) suggest that loss of control due to technological catastrophe may be longer lived because it represents failure in systems that were once under control and is not characterized by "the low" or clear end-point which characterizes natural disasters.

Previous research of reaction to technological disaster identified a specific kind of altered perception of control as loss of innocence associated with the loss of belief in a world of trustworthy authorities (Holt, 1982; Cutler and Barnes, 1981; Titchener, 1980). Cutler and Barnes (1980) found that 43% of TMI area residents surveyed in 1979 reported

loss of faith in experts. This percentage increased to 65% in 1980 (Cutler and Barnes, 1981).

Purpose of the Present Study

The primary purpose of the present study was to examine how prevalent concern about restart of Three Mile Island Unit I and TMI related health hazards were within the 5 mile radius of the plant 4 years after the accident. Our intention was also to explore how this concern related to expectation about restart of Unit I, perception of control, and selected demographic variables, such as whether or not a respondent had been a resident of Middletown at the time of the accident.

The significance of these questions is based on the suggestion by Baum (1983) that ongoing elevated stress levels in the community relate to widespread conditions of uncertainty and the experience of non-control in the Three Mile Island vicinity.

Consistent with Baum's suggestion, it was the hypothesis of the current authors that specific concerns pertaining to the technological disaster at Three Mile Island and its aftermath remain in a significant proportion of Middletown residents four years after the accident accompanied by altered perception of control.

Janoff-Bulman and Frieze (1983) suggest that the psychological response common to a variety of victims is the shattering of one's basic assumption of personal invulnerability. According to Janoff-Bulman and Frieze the experience of victimization forces individuals to confront previously and often unconsciously held assumptions of personal control and invulnerability. They suggest further that the coping process following victimization involves reworking one's assumptions about oneself and one's world so as to maintain a meaningful context into which to place one's experience as victim (Janoff-Bulman and Frieze, 1983).

It is our hypothesis that the loss of certainty of control over technology (Baum, 1983) and loss of control over one's physical safety experienced by Middletown residents may well

have shattered for many the illusion of invulnerability. As suggested by Holt (1982) those who believe that they or those they love have already been radiated and face illness, early death, or genetic death, are confronted with a lost sense of personal control.

Holt (1982), Vyner (1982, 1981) and Titchener (1979) have pointed out that the invisibility of ionizing radiation confronts people with a danger over which they have not been self-reliant because they cannot use their senses and their wits to protect themselves and those they love. For this reason, lay persons have been wholly dependent on authorities for every sort of information about radiation. Such an intensified reliance on experts for information and reassurance when unsatisfied may in turn lead to what Titchener has referred to as "loss of a believed--in secure world of benevolent and trustworthy authorities". In the chaos of conflicting statements issued at the time of the accident by officials of Met Ed, by spokespersons for the NRC, by mass media, and by state and local political leaders, citizens appear to have learned that seemingly authoritative pronouncements were likely to be contradicted a moment later. "Faith in experts crumbled as people saw so many of them confounded by an accident that they had said couldn't happen and which they did not seem to understand or be able to control" (Holt, 1982). Thus it was one intention of this study to determine the prevalence of perceived lack of control and loss of faith in experts among Middletown residents four years after the accident at Three Mile Island.

As we do not have pre-accident data on the beliefs and worries studied here, their relationship to the TMI accident can only be inferred. We have chosen, however, to compare those residents who were resident of Middletown during or before the accident with recent arrivals. Our assumption is that both groups are living with the same ongoing circumstances so that differences may be suggestive of impact of the accident.

In summary the questions addressed in this study are the following:

1. How prevalent are Three Mile Island Accident related health worries in the Middletown community four years after the accident?
2. How prevalent is perceive lack of control and loss of faith in experts?
3. How are these beliefs and worries related to each other and other relevant attitudinal and demographic variables?

METHOD

Subjects: A stratified random sample of residents of 221 households were interviewed in ten-minute face to face interviews summer and fall of 1983 more than 4 years following the Three Mile Island Accident.

Sampling: A two-stage area probability sample of 5% of households was selected from Middletown Borough, Pennsylvania. The 4,050 nouseholds enumerated in the 1980 U.S. Census of Population are divided into three census tracts and 12 block groups. A 5% sample of households was selected from each block group for a total of 221 households. In the first stage, using a table of random numbers, square blocks were selected at random for the sample from within each block group. All dwellings in each selected block were then enumerated, with careful attention being given to list every dwelling unit at each address. Households for interivew were then selected at random from the enumerated blocks, keeping to the quota of selecting 55 of dwellings from each block group. If a selected dwelling was found to be unoccupied, another address was selected at random from that same block. Interviewers were instructed to interview any adult resident at the designated address. Of the 221 selected households, interviews were completed in 214 dwellings, for a completion rate of 97%.

Demographics: The sample consisted of 130 females and 90 males ranging in age from 18 to 89. The average age of respondants was 36 and average length of residents in Middletown was 16 years. Average educational level of the sample was some college, but more than 50% of the sample had high school diplomas or less.

Occupational status was determined on the basis of categories established by the United States Bureau of Census Statistics:

7. Professional and technical

6. Managers, administrators, and business owners

5. Salesworkers

4. Clerical workers

3. Crafts workers; skilled tradesmen

2. Operatives; semi-skilled; plus service workers

1. Laborers

0. No occupation

Three Mile Island Beliefs and Worries Inventory

In this inventory developed by the first author for use in this study Beliefs about the restart were assessed by likert scale responses of degree of agreement from strongly disagree (1) to strongly agree (4) with the following statements:

1. "TMI Unit I will probably be restarted in the near future"

2. "TMI Unit I will probably be restarted, but not in the near future."

3. "TMI Unit I should be restarted when technical preparations are completed."

In addition an attitudinal discrepancy score was computed as the absolute value of difference between restart preference (3) and restart belief (1).

Three Mile Island related worry was assessed by likert scale response ranging from not at all woried (1) to very worried (4) to the following questions:

1. "To what extent are you worried about future accidents at TMI if Unit I is restarted?"
2. "To what extent are you worried about radiation exposure resulting from clean-up at TMI Unit II?"
3. "To what extent are you worried about developing cancer or radiation related diseases?"

Perception of control was assessed by likert scale response ranging from strongly disagree (1) to strongly agree (4) to the following statements.

1. "I can no longer trust people who I once considered to be experts."
2. "I don't believe I really have control over important aspects of my life."

Demographic questions were asked including one pertaining to residence in Middletown. The question of how long an individual had lived in Middletown was used to discriminate "pre-accident residents" and "recent arrivals".

RESULTS

Analyses included comparison of pre and post TMI accident residents using Chi-square analyses. In addition, the inter-relationship of TMI related beliefs and worries were explored using factor analyses. Relative contribution of belief and demographic variables to perception of control and lack of faith in experts was examined using multiple correlational analyses and stepwise regression.

Prevalence of Three Mile Island Related Beliefs and Worries

As shown on Table 1, 60% or more of Middletown residents surveyed indicated some concern about each of the TMI related worries. For those present at the time of the accident this was true of more than 65%. Of those present at the time of the accident 41.8% reported

lack of control and 50.6% reported loss of faith in experts. For recent arrivals these percentages were respectively 28.3% and 32.7%

Differences Between Pre and Post Accident Residents

Chi square analyses of prevalence of Three Mile Island related beliefs and worries, comparing those who had resided in Middletown during or prior to the accident with more recent arrivals suggested four areas of difference (See Table I).

Chi square analyses of discrepancy versus consistency between position on restart of Three Mile Island Unit I and expectation about whether restart will occur revealed that recent arrivals report more consistancy between restart preference and expectation than those who were residents of Middletown at the time of the accident ($p<.05$) (See Table I).

Chi square analyses of self-reported loss of faith in experts revealed that those residing in Middletown at the time of the accident were more likely to agree that they had lost faith in experts (50.6%) than recent arrivals (32.7%) ($p<.02$) (See Table I).

Chi square analyses of self-reported lack of control over significant aspects of life revealed that those residing in Middletown at the time of the accident were more likely to agree that they did not have control over significant aspects of their lives (41.8%) than were recent arrivals (28.3%) ($p<.03$) (See Table I).

Finally, Chi square analyses revealed that recent arrivals were more likely to indicate plans to move in the near future (See Table I).

TMI Related Worries and Demographics of Middletown Residents: Correlational analyses relating TMI worries with demographic variables revealed significant correlations in seven of fifteen cells. Parental status and age were related to most of TMI worry.

Parental Status was highly related to all three TMI-related worries, parents expressing more worry than non-parents. Age was also significantly related with younger people expressing more concern than older people. Gender difference pertained only to fear

of a future accident at TMI with women expressing more worry than men. Three Mile Island related worries were not significantly related to level of education or occupational category (See Table 2).

Analyses of the interaction of demographic variables, perceptions of control and length of time in Middletown was necessary because recent arrivals were different from previous residents of Middletown on a number of demographic variables. Cross-tabulations revealed significant interaction effects between self-reported loss of faith in experts and lack of perceived control with educational level and occupation as a function of length of time in Middletown.

Among those with high school diploma or less, residents of Middletown during the accident reported more perceived control than recent arrivals. Among those with college education, those present during the accident reported less perceived control than recent arrivals. Among college graduates, those present during the accident reported more loss faith in experts. These findings suggest that perception of control and faith in experts were more impacted by the TMI accident among those with more education (See Table 3).

Findings suggest that three of eight occupational groups were impacted by the TMI accident in relative perception of control. Professionals, administrators and business owners residing in Middletown at time of the accident reported more loss of faith in experts than most recent arrivals in those occupational groups. Crafts workers present at the time of the accident indicated less perceived control than more recent arrivals in that group (See Table 3).

Interrelatedness of Three Mile Island Beliefs and Worries Among Residents of Middletown: Collectively the ten items listed in Table 4 comprise the TMI Beliefs and Worries Inventory developed by the first author. Factor analysis was executed to determine whether the TMI relevant beliefs and worries of Middletown residents were systematically

related to each other. Factor analysis, with varimax rotation revealed three factors accounting for the total variance of response to these items by Three Mile Island area residents (See Table 4).

Factor I accounted for approximately 62% of the total variance with three TMI health related concerns loaded highest on this factor. The most significant of these was fear of radiation during clean-up of TMI Unit II, the damaged reactor. Opposition to restart of Unit I loaded to a lesser extend but significantly on this factor as did discrepancy between restart preference and restart belief. Slightly but significantly related to this factor was lack of perceived control. We have identified this as the "Health Worry Factor."

Variance of factor II was accounted for most by belief that TMI will restart in the near future and with disagreement that restart would be delayed. Slightly but significantly loaded on this factor were the belief that TMI Unit I should restart and the absence of worry about future accidents at TMI. This factor accounted for 27.9% of the total variance. We have identified this as the "Expectation of Restart Factor."

Factor III accounted for 10.3% of the total variance and consisted primarily of loss of faith in experts and perceived lack of control over important aspects of life. Slightly but significantly related to this factor were opposition to restart and worry about exposure to radiation during clean-up. We have identified this as the "Loss of Faith in Experts Factor."

Each of these factors accounted for a significant amount of the variance and were theoretically consistent with expectations.

Beliefs Related to Self-reported Lack of Control

A stepwise multiple regression analysis was employed to determine from best to worst the variables most predictive of self-reported lack of perceived control among residents in the vicinity of Three Mile Island (See Table 5). Variation in self-reported lack of control was partially accounted for (20%) primarily by three predictor variables; self-reported loss

of faith in experts (13%), worry about radiation exposure during clean-up of TMI Unit II (6%), and discrepancy between preference and expectation regarding restart of Three Mile Island I (1%). Causality and directionality cannot be determined from our data. F-ratio calculated for the total influence of each variable adjusted for preceding variables indicated statistical significance for the first two variables only.

Beliefs Related to Self-reported Loss of Faith in Experts

A stepwise multiple regression analysis was employed to determine from best to worst the variables most predictive of self-reported loss of faith in experts among Middletown residents in our sample (See Table 6). Self-reported loss of faith in experts is partially accounted for (16%) by three predictor variables; perceived lack of control (13%); worry about developing cancer or radiation related disease (3%); and whether or not someone was a resident of Middletown at the time of the accident (1%). Causality and directionality cannot be determined from our data. F-ratio calculated for the total influence of each variables adjusted for preceding variables indicated statistical significance for the first two predictor variables only.

Attitudinal Predictors of Opposition to Restart

A stepwise multiple regression analysis was employed to determine from best to worst, the variables most predictive of opposition to restart of Three Mile Island Unit I among Middletown residents in our sample (See Table 7). Variation in self-reported opposition to restart is partially accounted for by self-reported fear of another accident at Three Mile Island should Unit I be restarted (36%). The next best predictors accounting for 6% each of restart response variance may be considered cognitive consistency variables. The belief that Three Mile Island Unit I will not in fact be restarted, and the amount of discrepancy between what one wants and what one believes will actually occur regarding restart. The fourth best predictor accounting for 4% of the variance was independent

assessment of saliency of atomic energy as a national social problem. The last three predictor variables accounting for 1% of the variance each included the following: Worry about radiation exposure during clean-up of TMI Unit II; worry about developing cancer and other radiation related diseases; and residence in Middletown at the time of the accident. F-ratio calculated for unique influence of each variable indicated statistical significance ($p<.01$) for the first five predictor variables, and at the ($p<.05$) level for the last two variables. Causality and directionality cannot be determiend by our data.

Discussion

Discussion of TMI Related Worries Four Years After the Accident

Although our data did not include information on prevalence of TMI related health concerns in other areas or before the accident, comparison may be made with data collected by others shortly after the accident. Flynn (1979) asked repondents to report concern about radioactive emmissions from TMI before, during and after the accident as recalled in July 1979. Following is a comparison of Flynn's results with current findings.

	1979 Before	1979 During	1979 After	1984
Very concerned	12%	61%	41%	25%
Somewhat concerned	26%	25%	34%	42%
Not concerned	62%	14%	25%	34%
	(Flynn, 1981)			(Prince-Embury & Rooney, 1984)

This comparison suggests that concern in Middletown about radioactive emissions is less intense than concern in the area shortly after the accident and greater than that which

prevailed prior to the accident.

Recent concern about TMI (averaged over worry in three areas) may be compared with result of surveys conducted by Houts et al., April 1979, and January 1980 within 5 and 40 miles of the TMI facility.

% of Respondents Extremely Upset About TMI

	April 1979	January 1980	Fall 1983
Within 5 miles	52%	25%	26%
40 miles away	22%	14%	not tested

This comparison suggests that percent of the population expressing extreme upset in the Middletown community now is comparable to that which existed shortly after the accident with a 5 mile radius and greater than upset expressed by people more distant from the plant shortly after the accident.

Overall, these findings suggest that ongoing worry about physical safety persists in the TMI vicinity among a significant proportion of the population. There is indication that the intensity of the concern has lessened for many but not for all, remaining higher than that which exists in other areas or which existed in Middletown prior to the accident.

Manifestation of TMI Related Health Concerns in the Community

Our findings indicate that current TMI related worry relates to at least three specific health related concerns: fear of a future accident at TMI, radiation exposure during clean-up, and developing cancer or radiation disease. It is likely that these worries persist because of ongoing uncertainty and unanswered questions in all three areas. Houts (1980) found that those polled in the area believed that they stood a good chance of getting a

dangerous dose of radiation at some time in the future, and 54% believed that cancer rates will increase in the area because of TMI. Regarding restart, hardware safety and management integrity of GPU remain unsettled questions for many area residents. Regarding clean-up, many area residents report uncertainty about the actual safety of an unprecedented clean-up procedure which has already met with several mishaps. Fear of developing cancer may be prolonged for area residents by the lack of information about actual doses at time of the accident, the extended latency period for the development of symptoms and the absence of ongoing systematic studies of health effects in the area.

Although not systematically studied in our survey, informal observations suggest that for some community members, health related fears are associated with the observation of concrete physical phenomena, which although not meaningful at the time of the accident, became increasingly more meaningful as members of the community began seeking information about symptoms of exposure to low-level ionizing radiation. One woman who reports having experienced metalic taste the day of the accident explained how upsetting it was to her when she began to hear how others in the community had also had the experience. What she had orginally understood as a meaningless physical event unique to her, took on a different meaning when placed in a social context--that it was a reaction to some external event that had occurred to at least some members of the community independent of their knowledge that the TMI accident was occurring and independent of knowledge that anyone else was having a similar physical experience.

Some community members report another turning point in the way in which they held the meaning of their physical symptom when they began asking experts what the symptoms meant. Many report being told basically that releases during the accident were too low to have caused any symptoms, that there was no health effects and that whatever symptoms they had experienced were stress related. Informal observation has revealed in some

members of the community what might be labeled "epidemiological activism." This "epidemiological activism" in some community members manifests itself in mistrust of the state health department. This was aggravated by the documented ommission of 88 infant mortalities in one of the published studies of the department. Among a few, "epidemiological activism" has taken the form of seeking out public health specialists, and health physicists from outside the area in an attempt to get expert opinion which considers the possibility that the unusual physical symptoms reported have some medical reality. In the past five years, there have been at least five citizen-initiated health studies. One initiated by a school nurse found a higher than chance incidence of cancer in children of one local school. The most recent citizen-initiated health study occurred within the last year and was implemented by a small group of untrained housewives and mothers conducting door to door interviews in an area immediately down-wind from the plant. Their study revealed a cancer cluster containing six times the statistically anticipated cancer deaths for that area. Thus the TMI health related worry reported by more than half of our sample has manifested itself in a variety of ways presumably by community members for whom it is more intense.

Altered Perception of Control

Our findings suggest that those who were residents of Middletown at the time of the accident at Three Mile Island reflect less sense of personal control over important life events and more loss of faith in experts than do recent arrivals to the area. This is reflected also in a greater discrepancy in the former group between restart preference and expectation than is found among recent arrivals. Recent arrivals, although not as likely to report loss of control, report equal degrees of TMI-related worry. This suggests that the experience of the March 1979 accident itself contributed to loss of control among residents of Middletown at that time in a manner somewhat distinct from that which might result from remaining uncertainties.

Consideration of specific aspects of the Three Mile Island situation which might have differential effect on faith in experts and more general sense of control are suggestive of the following.

Lack of perceived control reflects loss of faith in experts, worry about radiation exposure during clean-up of TMI Unit II and discrepancy between what is preferred and what is expected regarding restart of Unit I. This suggests that perception of control in this community has been impacted by jarred expectations concerning trustworthiness of experts, physical safety, and control over a specific environmental event.

Loss of faith in experts, in addition to reflecting less sense of personal control, appears to reflect worry over developing cancer or radiation related disease and whether or not the respondent was a resident of Middletown at the time of the accident. Although direction of causality cannot be inferred, this finding is consistent with informal observation by the authors that those most worried about developing cancer are most markedly distrusting of experts. This finding may reflect in part the reality that no health care services have been established to address specific TMI related health concerns in the community, that there are no systematic studies of health effects being conducted, and that the local medical community by and large does not acknowledge legitimacy of concern in the community about possible health effects related to the TMI accident.

Our findings suggest further that within the Middletown community, the possible effect of the accident in altering perception of control is unevenly distributed and is mediated to some extent by demographic variables. Where demographic differences may generally exist in self-reported perception of control as in gender, educational level and occupational status, those who normally experience themselves as more in control: men, higher educated individuals, and professionals, were more subject to what might be referred to as an altered sense of invulnerability.

Finally, although our findings support the above impact on the Middletown residents as a group, it must be recalled that individual perception of control and faith in experts remained largely unaccounted for by our variables (80% to 84%) and reflect individual personality characteristics not examined in this study.

Psychosocial Components of Restart Position

Our findings are consistent with previous analyses which conclude that position on whether or not Unit I of the Three Mile Island Nuclear Plant should be restarted does not represent for most people a political ideology (Walsh, 1981; Rooney & Prince-Embury, 1984). Saliency of perception of atomic energy as a national social problem accounted for only 4% of the variance in restart position. Our data suggest, however, that 39% of variation on restart position relates to concern about health hazards with the immediate threat of a future accident accounting for most of this variance (36%).

In short, community members opposing restart believe that the plant is unsafe to operate and fear for their physical well-being should operations begin. On the other hand, those in favor of restart believe that the plant is safe.

Twelve percent of the variation on restart position is predicted by what an individual believes is likely to occur and the certainty with which this belief is held. Those opposing restart of Unit I are most likely to believe that the plant will not be restarted but with less certainty about their position than those who favor and anticipate restart.

Our findings indicate that restart positions held by Middletown residents reflect assessment of danger, are consistent to some extent with beliefs that minimize that danger, and are minimally reflective of a particular political ideology.

Our findings that 52.4% of the population in Middletown sample oppose restart are consistent with previous findings by Walsh (1981) who found that more than half of the population opposed restart. Our findings are somewhat less than the 2/3 majority opposing

restart in the 1982 tri-county referendum. This difference could reflect decreasing opposition, a tendency to change ones opinion to match what one believes will occur, or the fact that a large percentage of employees of the TMI plant whose jobs depend upon the plant remaining open live in Middletown where our survey was conducted.

TABLE 1

Chi Square Comparing TMI Related Beliefs and Worries in Residents of Middletown During The Three Mile Island Accident Versus Recent Arrivals

		Residents of Middletown during & before		Residents who arrived since the accident		X^2 Sign
Belief About Restart		%	N	%	N	p<
Belief that TMI will restart in near future		67.7	(109)	57.7	(30)	
Will not restart		13.0	(20)	15.4	(11)	
Will restart but not in near future		16.4	(25)	25.0	(13)	N S
		97.1	(154)	98.1	(54)	
Restart Preference						
Believe that TMI I should be restarted		45.4	(70)	50.9	(27)	
Should not be restarted		54.4	(84)	47.1	(28)	N S
		99.8	(154)	98.0	(55)	
Discrepancy						
Discrepancy between what is desired and what is anticipated regarding restart of Unit I	Discrepancy	41.5	(64)	31.7	(14)	
	Consistency	58.4	(90)	66.3	(38)	.05
		99.9	(154)	98.0	(52)	
Lost Faith in Experts						
Have lost faith in those once regarded as experts	Agree	50.6	(81)	32.7	(17)	
	Disagree	49.4	(73)	65.4	(34)	.02
		100.0	(154)	98.1	(51)	
Lack of Control						
Do not believe I have control over significant aspects of my life	Agree	41.8	(64)	28.3	(15)	
	Disagree	58.3	(90)	69.8	(37)	.03
		100.1	(154)	98.1	(52)	
TMI Related Worry						
Worry about future accidents	Yes	70.0	(112)	60.4	(32)	
	No	30.0	(48)	37.7	(20)	N S
Worry about clean-up Unit II	Yes	65.9	(106)	70.6	(36)	
	No	34.1	(55)	29.4	(15)	N S
Worry about cancer & radiation disease	Yes	67.6	(109)	60.3	(32)	
	No	32.4	(52)	35.8	(19)	N S
Plans to move in near future	Yes	16.7	(27)	37.7	(20)	
	No	83.2	(134)	60.4	(32)	.001

TABLE 2

Three Mile Island Related Beliefs and Worries
as Related to Demographics of Middletown Residents

r=Kendal Tau

	Gender	Age	Parental Status	Level of Education	Occupational Category
Worry about future accident at TMI	Women more worried r=.12*	Younger people more worried r=(-).24***	Parents more worried than non parents r=.32****	N. S.	N. S.
Worry about radiation exposure due to clean-up	No significant difference	Younger people more worried r=(-).21***	Parents more worried than non parents r=.30****	N. S.	N. S.
Worry about developing cancer or radiation related disease	No significant difference	Younger people more worried r=(-).15*	Parents more worried than non parents r=.22***	N. S.	N. S.
Believe I dont have control over important aspects of my life	Women more likely to agree r=.11*	N. S.	N. S.	Less educated (high school diploma) or less more likely to agree r=(-).14*	Professional/technical workers least likely to report lack of control clerical workers most likely r=.15
No longer trust those I once believed to be expected	N. S.	N. S.	N. S.	N. S.	N. S.
Discrepancy between what is wanted & what is expected regarding restart of TMI Unit I	Greater discrepancy present for women r=.18*	N. S.	N. S.	N. S.	Greater discrepancy present for those in occupations of higher socio-economic status

*p < .05 **p < .01 ***p < .001 ****p < .0001

TABLE 3

Interaction of Loss of Faith on Control with Residency During TMI Accident and Demographic Variables[1]

	Perceived Lack of Control	Loss of Faith in Experts
Gender:	More male residents of Middletown during the accident report lack of life control than male recent arrivers ($p<.05$). This relationship does not hold for females.	N. S.
Educational Level:	Residents of Middletown during the accident were more likely to report lack of control if they had college credit ($p<.02$); and less likely if they had only a high school diploma ($p<.009$).	Middletown residents with college degrees were more likely to report loss of faith in experts if they were residents of Middletown at the of the accident ($p<.009$).
Occupational Status:	Craft workers and skilled tradesmen residing in Middletown during the TMI accident more likely to report lack of control than recent arrivals in this category ($p<.01$).	Those in the occupational categories of professional/technical, manager, administrator or business owner were more likely to report loss of faith in experts if they were residents at the time of the accident r=.29 to 39 ($p<.09$).

[1]As indicated by Chi square analyses

TABLE 4

Factor Analysis of Beliefs and Worries of Residents of Three Mile Island Vicinity (Varimax Rotation)

Items	FACTOR TITLE: Health Worry	Expectation of Restart	Loss of Faith in Experts
	61.8% of variance	27.9% of variance	10.3% of variance
1. Belief that TMI Unit I will restart in near future.	-.10911	.99100**	.01227
2. Belief that Unit I will restart but not in the near future.	.02039	-.73065**	.04614
3. Belief that TMI Unit I should be restarted	-.57570**	.29736*	-.22169*
4. I plan to move in the near future	.19939*	.06566	.06883
5. I no longer trust people I once considered experts	.12637	-.08385	.62907**
6. I don't believe I have control over important aspects of my life	.20941*	.03427	.50715**
7. I am worried about future accidents at TMI	.84150**	-.20895*	.10006
8. I am worried about radiation exposure during clean-up	.88459**	-.12901	.20430*
9. I am worried about developing cancer or radiation related disease	.79103**	-.10650	.12690
10. Discrepancy between preference and belief about restart of Unit I	.41376**	.14655	.19119*

* $p<.05$
** $p<.01$

TABLE 5

Multiple Regression Analysis of Variables Predicting Self-Report That One Does Not Have Control Over Important Aspects of Life Among Residents of The Three Mile Island Community

	R	Multiple R	R Square	RSQ Change	F
Loss of faith in experts.	.36***	.36	.13	.13	32.5**
Worry about radiation exposure during clean-up.	.32***	.43	.19	.06	15.0**
Discrepancy between restart position & expectation.	.15	.44	.19	.01	2.5
Gender	.13	.44	.20	.003	N S
Worry about developing cancer and radiation related disease.	.24**	.45	.20	.003	N S
Worry about future accidents at TMI	.25**	.45	.20	.0002	N S

**P < .01
***P < .001

TABLE 6

Multiple Regression Analysis of Variables Predicting Self-Reported Loss of Faith in Experts Among Residents in the TMI Vicinity

	R	Multiple R	R Square	RSQ Change	F
Perceived lack of control over important aspects of my life.	.36**	.36	.13	.13	26**
Worry about developing cancer or radiation related disease.	.24**	.39	.15	.03	6**
Residency in Middletown before or after TMI accident.	.11	.40	.16	.01	1.2
Discrepancy between position on restart & restart expectation.	.12	.40	.16	.002	N S
Gender	.10	.40	.16	.002	N S
Worry about future accidents at TMI.	.18	.41	.16	.002	N S
Worry about radiation exposure during clean-up.	.24**	.41	.16	.000	N S

**P< .01

TABLE 7

Multiple Regression Analysis of Variables
Predictive of Opposition to Restart of Three Mile Island
Unit I Among Residents of Middletown

	R	Multiple R	R Square	RSQ Change	F
Worry about another accident at TMI if Unit I is restarted	.60	.60	.36	.36	14.24**
Belief that TMI Unit I will not be restarted	.40	.65	.42	.06	30.14**
Amount of discrepancy between what one wants regarding restart and what one expects will occur	.35	.69	.48	.06	17.07**
Saliency of atomic energy as a national social problem	.40	.72	.51	.04	10.09**
Worry about radiation exposure during clean-up of TMI Unit II	.57	.72	.52	.01	8.79**
Worry about developing cancer and other radiation related diseases	.42	.73	.53	.01	4.12*
Residence in Middletown at the time of the accident	.13	.74	.54	.01	3.44*

* $p<.05$
** $p<.01$

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